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The Influence of Layer-to-Layer Misalignment on the Microwave Performance of LTCC Antenna Modules

4. Micro- and Nanoelectronics

Abstract: LTCC (Low Temperature Cofired Ceramics) dielectrics have a higher permittivity than most of the common organic circuit boards. Together with good RF-performance and nearly arbitrary layer count these are excellent prerequisites for high packaging density. The well-established screen-printing process used in LTCC is a further benefit in the volume production of this rugged design. However, there are some tradeoffs: Particularly in the frequency range considered here, miniaturization leads also to challenging demands in terms of manufacturing tolerances. It is quite obvious that apart from tolerances in material properties (permittivity and loss angle) deviations in the geometry will influence the overall system performance. In order to turn this often qualitatively heard discussion into quantifiable requirements, an 11-layer LTCC module was investigated thoroughly using a 3-D full wave EM simulation software. This paper will concentrate on the effect of layer-to-layer misalignment which is particularly interesting where vertical microwave transitions are necessary for vertical integration. The antenna module presented here represents a 4 x 4 element array building for digital beam forming at 30 GHz. The polarisation of the antenna patch elements is circular. Each element is fed by an individual hybrid coupler feed. The area for this circuitry is limited to the grid defined by the cell size of one element. In addition, the array requires a complex integrated calibration network. This high density microwave integration can be achieved by vertical integration in an LTCC-Multilayer.

Keywords: LTCC, Ka-Band, Planar Antenna, Satellite Communication, Manufacturing Tolerances

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